

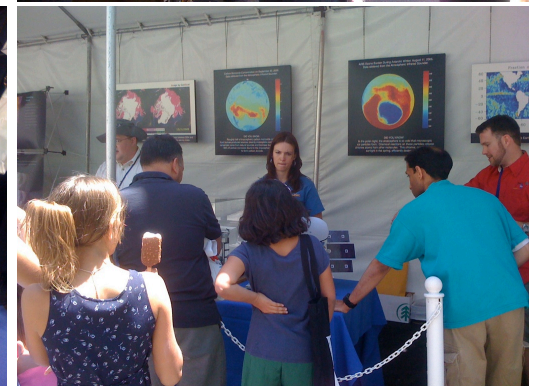


# AIRS Outreach

## Science Team Meeting Oct 2008 - Sharon Ray



*AMS New Orleans  
Climate Day Los Angeles  
JPL Open House*



# The New AIRS Web Site

Launched 9/29/08

Check out the new AIRS web site at [airs.jpl.nasa.gov](http://airs.jpl.nasa.gov)



The screenshot shows the AIRS web site interface. At the top, there is a NASA logo and the text "Jet Propulsion Laboratory California Institute of Technology". Navigation links include "JPL HOME", "EARTH", "SOLAR SYSTEM", "STARS & GALAXIES", and "SCIENCE & TECHNOLOGY". A secondary navigation bar says "BRING THE UNIVERSE TO YOU:" with links for "JPL Email News", "News", "RSS", "Podcast", and "Videos".

The main content area is divided into several sections:

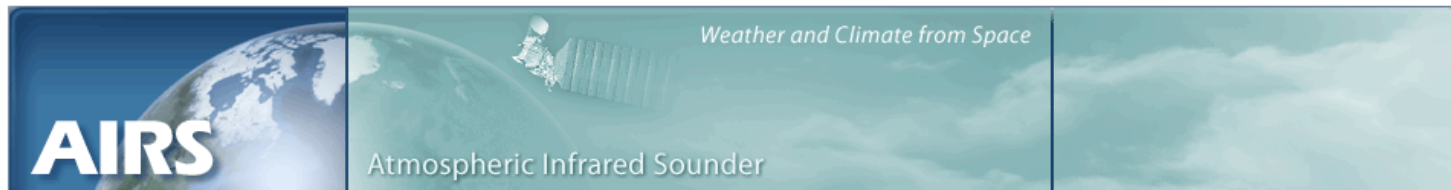
- Header:** "Weather and Climate from Space" and "Atmospheric Infrared Sounder".
- Left Sidebar:** A vertical menu with links: Home, Overview, Science, Technology, Data Products, Multimedia, Documents, and Directory. Below the menu is a search box.
- Center:** A large image of Earth with the text "Press Release: New Maps of CO2" and "New maps from AIRS show the distribution and transport of CO2". Below this is a "Maps in Motion" section with tabs for "Water Vapor", "Carbon Monoxide", and "Temperature". A large map shows "AIRS: 2008.06.01" with "AIRS daily water vapor at 500 mb. (18,000 ft./ 5.5 km altitude)".
- Right Sidebar:** "HEADLINES" section with three items: "New Maps of CO2", "Science Meeting Oct 14-17", and "Rapid Response image TBD". Below this is a "Satellite Feed" section with a map and a legend for "AIRS daily total precipitable water vapor (millimeters)".
- Bottom:** A footer with "USA.gov" logo, "DATA USERS NEWS", "OUTREACH", "FOR PRESS", "PRIVACY", and "CONTACT". It also lists "Site Manager: Sharon Ray" and "Webmaster: Ying Mei Chen".



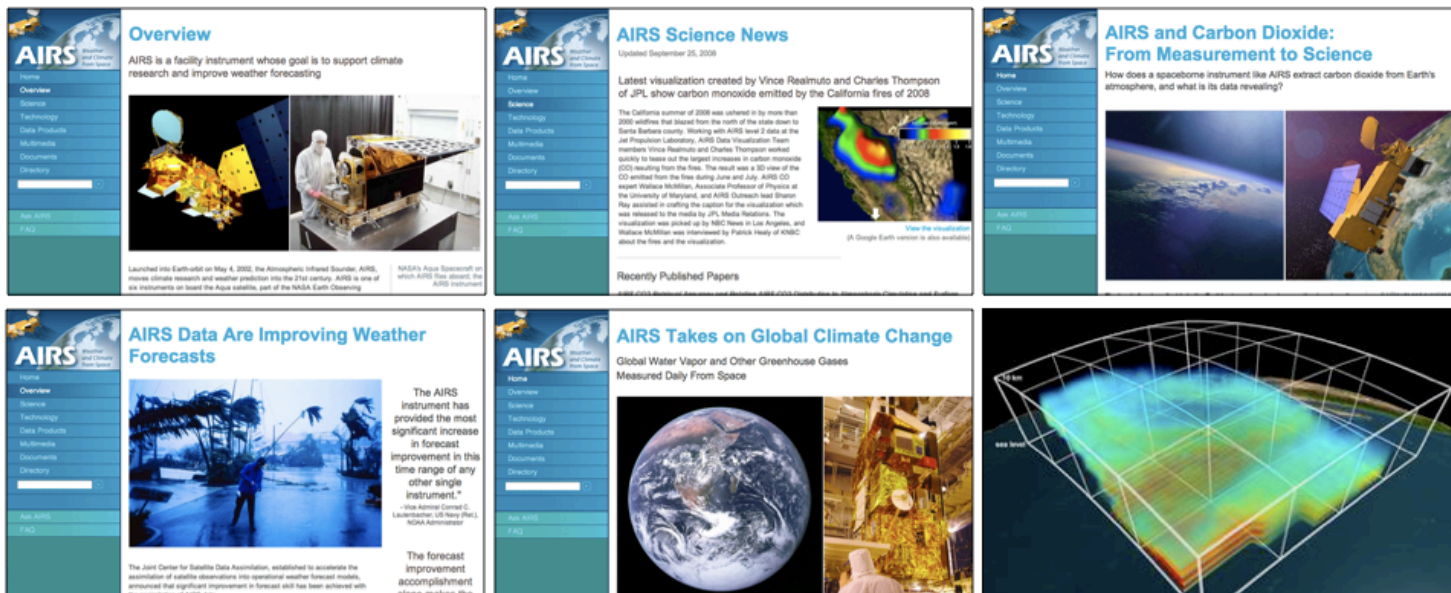


Jet Propulsion Laboratory  
California Institute of Technology

# The New AIRS Web Site



News, data, animations, information — The Atmospheric Infrared Sounder on NASA's Aqua satellite is making a difference in the science of Earth's weather and climate



“The AIRS instrument has provided the most significant increase in forecast improvement in this time range of any other single instrument.”

- Vice Admiral Conrad C. Lautenbacher, US Navy (Ret.), NOAA Administrator

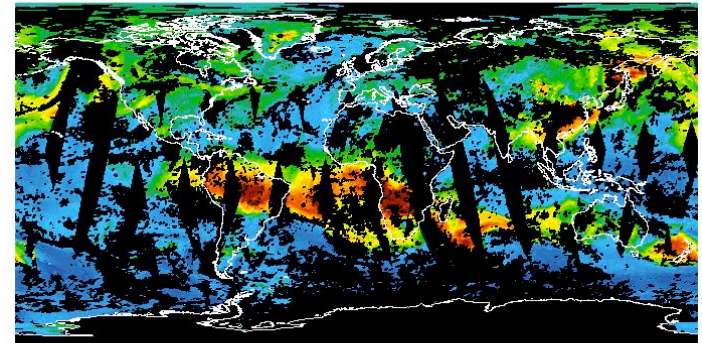
“The [weather] forecast improvement accomplishment alone makes the AIRS project well worth the American taxpayers investment”

- Dr. Mary Cleave, associate administrator of NASA's Science Mission Directorate

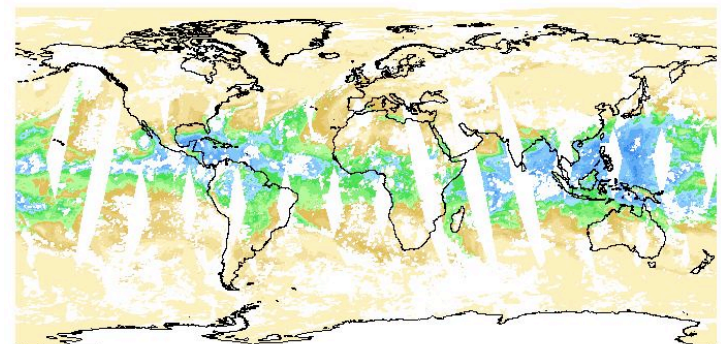
# The New AIRS Web Site

- Serving the Public & the Science Communities
  - Overviews, Stories, Maps, Rapid Reponse, Multimedia
  - Major Findings, Papers, Extensive Data Information, AskAIRS, FAQ
- New Organization
  - Easy access
  - Get imagery the way you want it. Organized by: geophysical data product, natural hazard, visualizations, animations, video
- New Look
  - Lots of visuals with links to NASA databases
- New Features
  - **Maps In Motion:** archive of the “pretty version” of 10 data products from the beginning of the mission
  - **Maps from Satellite Feed coming soon:** daily images of 6 data products. Image is zeroed out at night, builds up during the day as granules come in
  - Science News
  - FAQ
  - Publications Database
- Efficient Image Archive Strategy
- Fast updates
  - iWeb development environment

AIRS CO AT 505mb (ppbv) 20081010



AIRS TOTAL PRECIPITABLE WATER VAPOR (millimeters) 20081010





# The New AIRS Web Site

## More content please

- Papers
  - Publications Database
  - possible web feature (home page headline)
- Feature stories
  - Home page headline
  - Could feed to the Global Climate Change web site
- Science News
  - informal, to highlight an image, field campaign, anything
  - latest papers
- Video
  - build up our scientist interviews gallery
- Multimedia Gallery
  - add your image/movie/plot

### Teasing out Carbon Dioxide From Earth's Atmosphere: An interview with Cyril Crevoisier

Cyril Crevoisier of France's National Center for Scientific Research talks about the challenges of retrieving atmospheric CO2 and his effort to find its sources and sinks

My name is Cyril Crevoisier. I was formerly a Ph.D. student in Paris at the [Laboratoire de Météorologie Dynamique](#), working with Alan Chedin, and we were working on CO2 retrievals from AIRS observations. Since October 2004 I've been doing a post-doc at Princeton University, estimating carbon sources and sinks at Earth's surface.

I'm now working with Alan Chedin and Noelle Scott of the [Laboratoire de Météorologie Dynamique](#). They have been involved in using satellite observations for about 20 or 30 years now and so have very good knowledge of all these instruments. They began looking at TOVS [data for] observations of CO2. The TOVS instruments were first launched in 1972 and are still operating now, but they have very small spectral resolution which means we cannot really extract all the information about different species – CO2, methane, etc. Whereas with AIRS, the spectral resolution has really increased so we have a lot more information about CO2.



Dr. Cyril Crevoisier

Cyril Corvouisier  
 Andrew Dessler  
 Larrabee Strow  
 Mitch Goldberg  
 Walter Wolff

David Neilan  
 Chris Barnet  
 Mous Chahine  
 Andrew Gettleman  
 Laura Pan

# Global Climate Change Web Site

Launched June 15, 2008

- 1.2 million hits/99,000 page views in first two weeks
- Already a top 10 Google search result for 'Global Climate Change'
- Earth Vital Signs Widget: Number 9 out of over 3,700 widgets on Apple.com
- Solid following on Twitter



# A Focus on Visual Elements

News...key climate change indicators...interactives...  
 videos...NASA's role in climate science research

**GLOBAL CLIMATE CHANGE**  
 NASA's Eyes on the Earth

**EVIDENCE**  
 Global change: How do we know?

For 650,000 years, atmospheric CO<sub>2</sub> has never been above this line... until now

2007 current level

1950

CO<sub>2</sub> parts per million

YEARS before today (0 = 1950)

Source: Vostok ice core data

The Earth's climate has changed throughout history. Just in the last 650,000 years, there have been

**GLOBAL CLIMATE CHANGE**  
 NASA's Eyes on the Earth

**UNCERTAINTIES**  
 Unresolved questions about Earth's climate

Extreme Ultraviolet Imaging Telescope (EIT) image of a huge, multi-colored prominence in 1997. While there is no evidence of a change in color (red/orange) over the past half century, long-term changes in solar output are not well understood.

This website presents a data-rich view of climate and a discussion of how that data fits together into the scientific, complex picture of our changing climate. But there's a catch: that's as best we know.

**GLOBAL CLIMATE CHANGE**  
 NASA's Eyes on the Earth

**EFFECTS**  
 The current and future consequences of global change

The current and future effects of global climate change include more frequent extreme, longer periods of drought in some regions and an increase in the number, duration and intensity of tropical storms.

Global climate change has already had observable effects on the environment. Glaciers have shrunk, ice on rivers and lakes is breaking up earlier, plant and animal ranges have shifted and trees are flowering sooner.

Effects that scientists had predicted in the past would result from global climate change are now occurring: loss of sea ice, accelerated sea level rise and longer, more intense heat waves.

Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities. The Intergovernmental Panel on Climate Change (IPCC), which includes more than 100 countries, has published evidence that this is the case.

So, the Earth's average temperature has increased about 1 degree Fahrenheit during the 20th century. What's the big deal?

One degree may sound like a small amount, but it's a

**SEA LEVEL VIEWER**

Large El Niño November 1997

Large El Niño November 1997

The extra-large El Niño of 1997 and 1998 was the most intense in over a century. It played havoc with normal climate patterns, triggering forest fires, floods, and disruption to fisheries and agriculture.

OVERVIEW MISSIONS

**GLOBAL CLIMATE CHANGE**  
 NASA's Eyes on the Earth

**KEY INDICATORS**  
 Sea Level

HISTORICAL DATA - 1880-1990  
 RATE OF CHANGE  
 ↑ 2 mm per year (estimated)

LATEST DATA - 1993-PRESENT  
 RATE OF CHANGE  
 ↑ 3.4 mm per year (estimated)

Current sea level data furnished by Jason-1

The chart on the left shows historical sea level data derived from 23 tide-gauge measurements. The chart on the right shows the average sea level since 1993 derived from global satellite measurements, updated here monthly. Sea level rise is associated with the thermal expansion of

**GLOBAL CLIMATE CHANGE**  
 NASA's Eyes on the Earth

**CAUSES**  
 The greenhouse effect

Light and heat travel from the sun to the Earth. Much of it reflects off of the surface of the planet and back into outer space.

Some of the heat is absorbed by gases in the atmosphere, like carbon dioxide. This warms the surface of the Earth.

A heat-trapping layer of greenhouse gases is primarily carbon dioxide. It acts as a thermal blanket for the Earth, trapping heat and warming the surface by the surprising average of 59 degrees Fahrenheit (15 degrees Celsius).

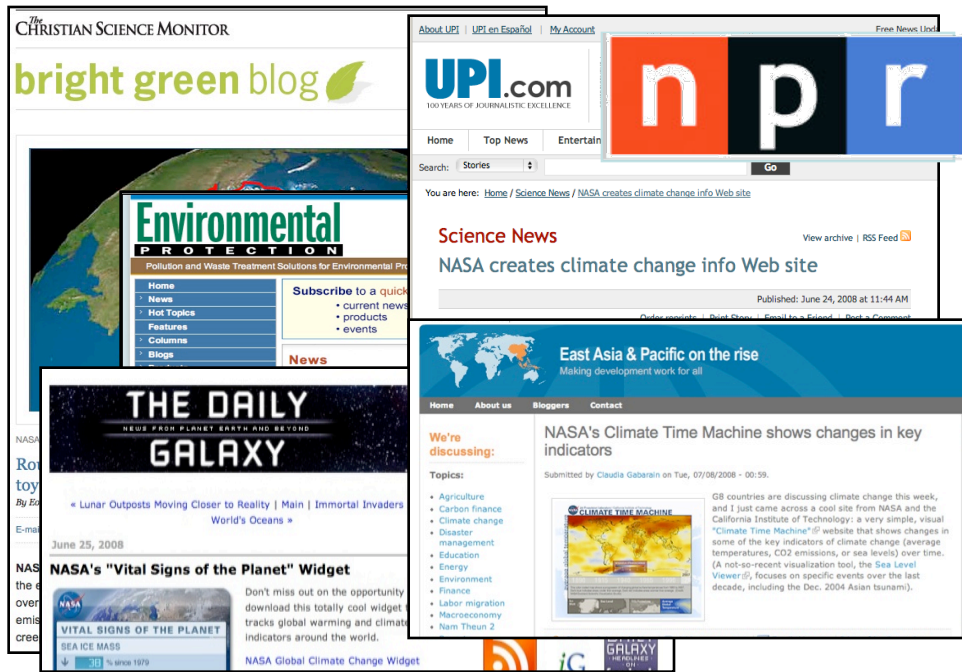
Most scientists agree the main cause of the current global warming trend is human expansion of the "greenhouse effect" - warming that results when the atmosphere traps heat radiating from Earth.

We live in a greenhouse.



# Strong Reviews from Media, Web Pundits, and Users

Dozens of articles; 300+ blog postings



Reaching into the Web 2.0 World



Earth Vital Signs Widget: Number 9 out of over 3,700 widgets on Apple.com



A solid following on Twitter

I plan to have it a classroom staple.  
*–J.R.Waring, Earth science teacher*

The “Climate Time Machine” .... will knock your socks off.  
*–Greg Laden, Science and Engineers for America*



# Target Outlets

- The Web
  - AIRS, Global Climate Change, JPL Home, Earth Observatory, NASA Home, NASA Earth
  - Discovery EarthLive, Google Earth
  - Wikipedia
- Print
  - Weatherwise
- Radio
- Broadcast
  - Event-driven visualizations for News outlets
  - CO visualization on KNBC
  - AIRS hurricane image on Fox News





# News Release: NASA Maps Shed Insights Into Its Global Nature

• Issued October 9

Chahine, M. T., L. Chen, P. Dimotakis, X. Jiang, Q. Li, E. T. Olsen, T. Pagano, J. Randerson, and Y. L. Yung (2008), **Satellite remote sounding of mid-tropospheric CO<sub>2</sub>**, Geophys. Res. Lett., 35, L17807, <http://dx.doi.org/10.1029/2008GL035022> 9 September 2008

October 09, 2008 PASADENA, Calif.

- A NASA/university team has published the first global satellite maps of the key greenhouse gas carbon dioxide in Earth's mid-troposphere, an area about 8 kilometers, or 5 miles, above Earth. The team's study reveals new information on how carbon dioxide, which directly contributes to climate change, is distributed in Earth's atmosphere and moves around our world.

The screenshot shows a news article on the China View website. The main headline is "U.S. publishes first global carbon dioxide map" dated 2008-10-11 04:21:08. The article text states: "A team of U.S. researchers published the first global satellite maps of carbon dioxide in Earth's mid-troposphere, an area about 8 kilometers, or 5 miles, above Earth, the space agency NASA reported Friday. The maps show how carbon dioxide, which directly contributes to climate change, is distributed in Earth's atmosphere and moves around our world." Below the article is a "Climate Change: The Next Generation" sidebar with a "BLOG ARCHIVE" for October 2008, listing various climate-related news items.

The screenshot shows the NASA website homepage. The navigation bar includes "HOME", "NEWS", "MISSIONS", "MULTIMEDIA", and "ABOUT NASA". The "Latest Features" section prominently displays the article "NASA Maps Shed Light on Carbon Dioxide's Global Nature" with a thumbnail image of the CO<sub>2</sub> map and the date "10.09.08". A sidebar on the left lists "News Topics" such as "Shuttle & Station", "Moon & Mars", "Solar System", "Universe", "Aeronautics", and "Earth".

The screenshot shows an article on the Siobreaker website titled "New Details on Carbon Dioxide's Global Nature" dated Saturday, 11 October 2008 07:39. The article text reads: "PASADENA, Calif. - A NASA team has published the first global satellite maps of the key greenhouse gas carbon dioxide in Earth's mid-troposphere, an area about 8 kilometers, or 5 miles, above Earth. The team's study reveals new information on how carbon dioxide,..." Below the article is a "Quotes" section with a quote from M. T. Chahine: "No place on Earth is immune from its influence. It will take many independent measurements, including AIRS, to coax this culprit out of hiding and track its progress from creation to storage." The article also includes a "We Recommend" section with links to related news items.





# Web Stats

## September 2008

**3,644 visits came from 105 countries/territories**

Detail Level: [City](#) | [Country/Territory](#) | [Sub-Continent Region](#) | [Continent](#) Dimension: [None](#)

**Site Usage** **Goal Conversion**

Visits: **3,644** (100.00% of Site Total)  
Pages/Visit: **3.20** (Site Avg: 3.20 (0.00%))  
Avg. Time on Site: **00:00:00** (Site Avg: ...)

Detail Level: [Country/Territory](#)

1.	<a href="#">United States</a>
2.	<a href="#">United Kingdom</a>
3.	<a href="#">Japan</a>
4.	<a href="#">Canada</a>
5.	<a href="#">India</a>
6.	<a href="#">Germany</a>
7.	<a href="#">Australia</a>
8.	<a href="#">France</a>
9.	<a href="#">China</a>
10.	<a href="#">Mexico</a>

**3,644 Visits**  
**2,975 Absolute Unique Visitors**  
**11,668 Pageviews**  
**3.20 Average Pageviews**  
**00:02:22 Time on Site**  
**52.09% Bounce Rate**  
**78.13% New Visits**

Page

1.	<a href="#">/</a>
2.	<a href="#">/Data/</a>
3.	<a href="#">/Data/DailyMaps/</a>
4.	<a href="#">/News/Events/</a>
5.	<a href="#">/Products/</a>
6.	<a href="#">/WeatherSnapshots/HurricaneGustav/</a>
7.	<a href="#">/Data/GetAIRSdata/</a>
8.	<a href="#">/Science/</a>
9.	<a href="#">/Products/CarbonDioxide/</a>
10.	<a href="#">/Mission/</a>

Visits: **3,644** (100.00% of Site Total)  
Pages: **3.20** (Site Avg: ...)

Source/Medium

1.	<a href="#">google / organic</a>
2.	<a href="#">(direct) / (none)</a>
3.	<a href="#">yahoo / organic</a>
4.	<a href="#">search.nasa.gov / referral</a>
5.	<a href="#">climate.jpl.nasa.gov / referral</a>
6.	<a href="#">search.jpl.nasa.gov:8080 / referral</a>
7.	<a href="#">photojournal.jpl.nasa.gov / referral</a>
8.	<a href="#">jpl.nasa.gov / referral</a>
9.	<a href="#">images.google.com / referral</a>
10.	<a href="#">nasa.gov / referral</a>

## October 1-12, 2008

Visits: **7,672** (100.00% of Site Total)

Detail Level: [Country/Territory](#)

1.	<a href="#">Italy</a>
2.	<a href="#">United States</a>
3.	<a href="#">United Kingdom</a>
4.	<a href="#">Germany</a>
5.	<a href="#">France</a>
6.	<a href="#">Canada</a>
7.	<a href="#">Switzerland</a>
8.	<a href="#">Spain</a>
9.	<a href="#">Japan</a>
10.	<a href="#">Netherlands</a>

Page

1.	<a href="#">/story_archive/Measuring_CO2_from_Space/</a>
2.	<a href="#">/</a>
3.	<a href="#">/meetings/science-team-greenbelt/</a>
4.	<a href="#">/maps/maps_in_motion/</a>
5.	<a href="#">/overview/overview/</a>
6.	<a href="#">/science/news/</a>
7.	<a href="#">/multimedia/geophysical_products_multimedia/carbon_dioxide/</a>
8.	<a href="#">/data_products/data_product_descriptions/</a>
9.	<a href="#">/story_archive/Measuring_CO2_from_Space/Measurement_to_Science/</a>
10.	<a href="#">/multimedia/geophysical_products_multimedia/</a>

• News Release Issued October 9



**7,672 Visits**  
**7,122 Absolute Unique Visitors**  
**14,067 Pageviews**  
**1.83 Average Pageviews**  
**00:01:11 Time on Site**  
**72.73% Bounce Rate**  
**90.92% New Visits**

Sources

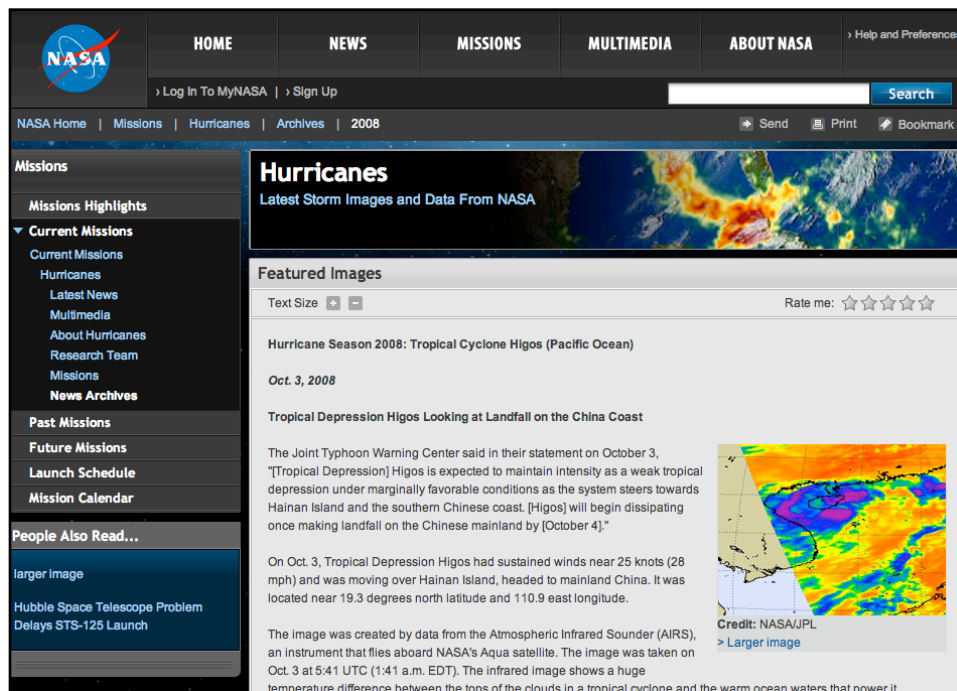
<a href="#">corriere.it (referral)</a>
<a href="#">(direct) ((none))</a>
<a href="#">google (organic)</a>
<a href="#">climate.jpl.nasa.gov (referral)</a>
<a href="#">nasa.gov (referral)</a>

## *As of October 12*

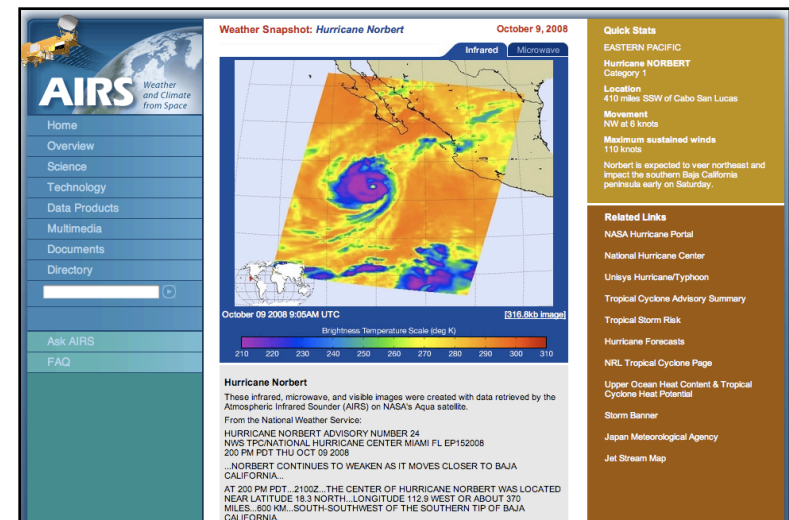
- Google Search Terms
  - carbon dioxide: 19th
  - carbon dioxide map: 4th; 3 of the first 10
  - carbon dioxide map - images: 7th, 9th of 449k results
- Yahoo Search Terms
  - carbon dioxide: -
  - carbon dioxide map: 3rd, 4th of 16.5 million results
  - carbon dioxide map - images: 24th of 504 results
- Cited on 184 blogs

# Hurricane Rapid Response

- AIRS supplied 41 of the 60 images used by the NASA Hurricane portal so far during the 2008 Hurricane Season
- NASA Hurricane Page - almost half a million visitors in September
  - The NASA Hurricane page pulled in 495,979 hits in the month of September (per Rob Garner, NASA Goddard web master)

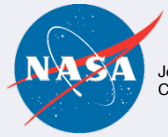


The screenshot shows the NASA Hurricane portal homepage. At the top, there is a navigation bar with links for HOME, NEWS, MISSIONS, MULTIMEDIA, and ABOUT NASA. Below this is a search bar and a secondary navigation bar with links for NASA Home, Missions, Hurricanes, Archives, and 2008. The main content area features a large satellite image of a hurricane and a section titled "Featured Images" with a sub-heading "Hurricane Season 2008: Tropical Cyclone Higos (Pacific Ocean)". The featured image is dated "Oct. 3, 2008" and is titled "Tropical Depression Higos Looking at Landfall on the China Coast". The text below the image describes the storm's path and intensity, mentioning the Joint Typhoon Warning Center's statement. A smaller satellite image of the storm is shown to the right of the text, with a credit to NASA/JPL and a link to a larger image.



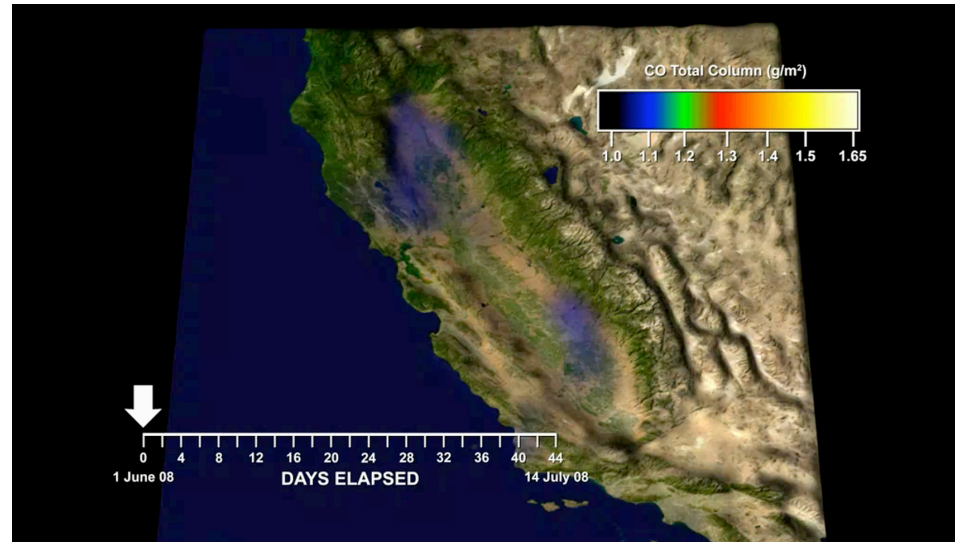
The screenshot shows the AIRS Weather Snapshot for Hurricane Norbert on October 9, 2008. The page features a large satellite image of the hurricane with a color scale for brightness temperature. The scale ranges from 210 to 310 degrees Kelvin, with a color gradient from blue (cooler) to red (warmer). The hurricane's eye is visible as a dark blue/purple circle. The page includes a sidebar with navigation links (Home, Overview, Science, Technology, Data Products, Multimedia, Documents, Directory) and a "Quick Stats" section. The Quick Stats section provides key information about Hurricane Norbert, including its location (410 miles SSW of Cabo San Lucas), movement (NW at 6 knots), and maximum sustained winds (110 knots). It also includes a "Related Links" section with various resources for hurricane information.





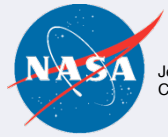
Jet Propulsion Laboratory  
California Institute of Technology

## New Visualization



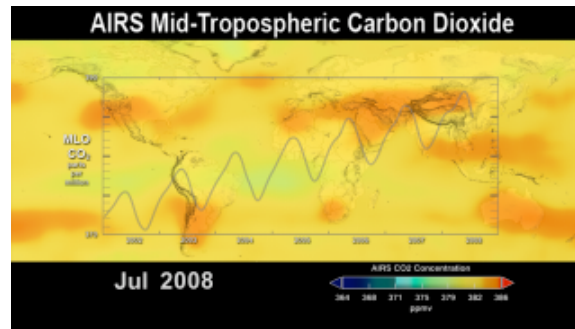
### Carbon Monoxide from California's Wildfires

Visualization of the rapid increases in carbon monoxide (CO) emitted by fires burning in California in June and July 2008. Only the largest values of CO detected by AIRS are shown to highlight the impact of the fires. AIRS primarily observes CO in a layer from 2 to 7 kilometers above Earth's surface. Thus, it tends to see where the wind blows the carbon monoxide and not just the smoke directly above the fires. However, many of these intense fires lofted a significant amount of carbon monoxide directly above the fires, making the hotspots also visible to AIRS.

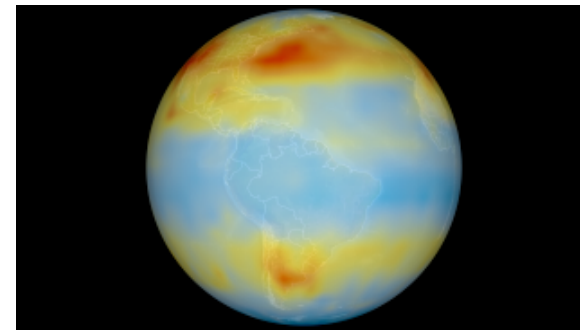


Jet Propulsion Laboratory  
California Institute of Technology

## New Visualization



CO2 with Mauna Loa Data Overlaid

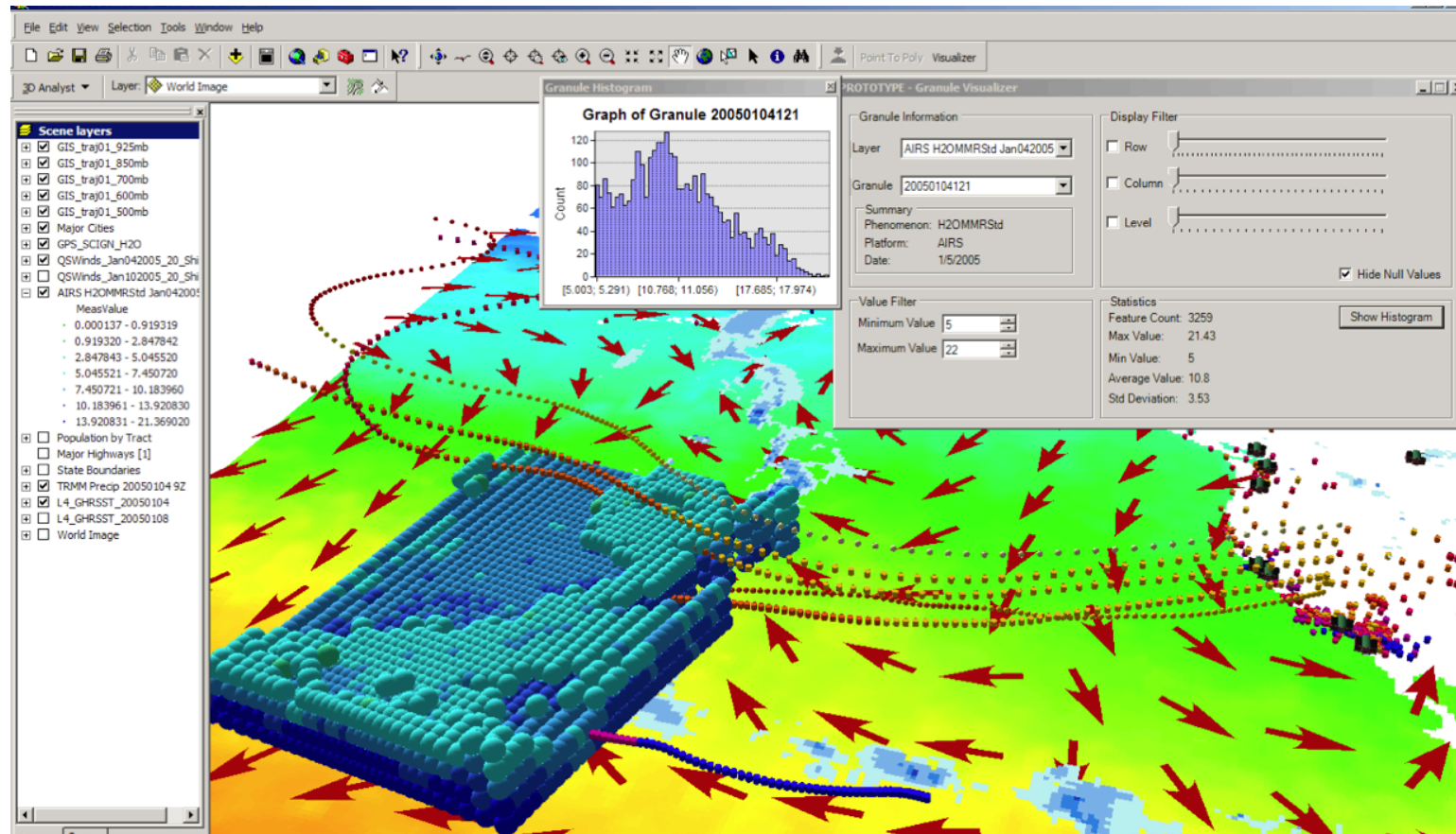


AIRS Sees Belt of CO2 in Southern Hemisphere, July 2003

- Created by Lori Perkins, GSFC SVS



# New Visualization

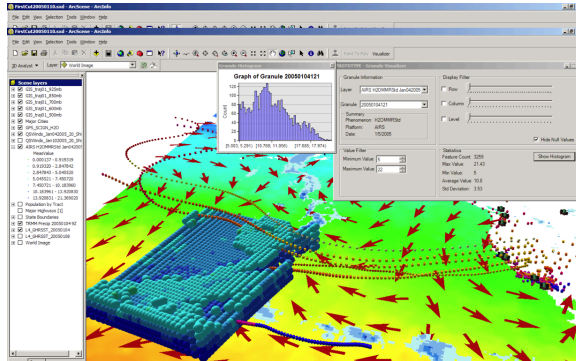


Three-Dimensional View Of Water Vapor Transport Along A Pacific Basin Atmospheric River, January 4, 2005





## New Visualization



### Three-Dimensional View Of Water Vapor Transport Along A Pacific Basin Atmospheric River, January 4, 2005

The development of a plug-in prototype GIS tool had, as a science driver, a case study examining the role of water vapor transport along an atmospheric river across the Pacific Basin in January 2005. During this time period an extreme precipitation event was produced. This event caused significant amounts of rain to fall over much of California, triggering mudslides that resulted in millions of dollars of damage and a dozen deaths.

The study characterized the three-dimensional distribution of water vapor during the event and related surface winds and height-resolved water vapor to coastal rainfall. Measurements were supplied by a host of spaceborne instruments and one ground-based instruments. These measurements consisted of: water vapor from the AIRS instrument, surface winds from QuikSCAT, precipitation from TRMM, sea surface temperature from GHRSSST, and integrated water vapor from SCIGN ground-based GPS. Back-in-time trajectories were provided by HYSPLIT.

In this figure, a granule of AIRS water vapor data was subsetting to show the points with highest values of water vapor in the northeastern Pacific. These measurements are shown as a point cloud superimposed on a background of GHRSSST sea surface temperatures, TRMM precipitation, and QuikSCAT wind vectors.

To the right of the image, water vapor amounts from the SCIGN GPS network are shown color-coded by absolute magnitude for various stations. Back trajectories from the NOAA HYSPLIT model are shown as dotted lines, indicating the relationship between the atmospheric water vapor over the Pacific and water vapor over land. A histogram of the AIRS data values is also shown in the top center of the image.



# Carbon Markets Insights Conference



“Point Carbon is a world-leading provider of independent news, analysis and consulting services for European and global power, gas and carbon markets.”

“...the number one supplier of unrivaled market intelligence of these markets.”

“Our staff includes experts in international and regional climate policy, mathematical and economic modeling, forecasting methodologies, risk management and market reporting.”

- **New Audience**
  - Congressional staffers, venture capitalists, policy makers
- **Objective**
  - Convey that JPL is a leader in the remote sensing of CO<sub>2</sub>
  - unbiased, global data that is free
  - introduce existing data (AIRS) and new missions (OCO & Ascends)
- **AIRS & OCO presence, booth**
  - Staffed by Tom Pagano & Sharon Ray (AIRS), Stacey Boland OCO

Book:  
**Atmospheric Science at NASA - A History**

- **Chronicles the history of atmospheric science at NASA**

- traces the story from its beginnings in 1958, the International Geophysical Year, through to the present, focusing on NASA's programs and research in meteorology, stratospheric ozone depletion, and planetary climates and global warming. But the story is not only a scientific one.

- NASA's researchers operated within an often politically contentious environment. Although environmental issues garnered strong public and political support in the 1970s, the following decades saw increased opposition to environmentalism as a threat to free market capitalism.

- **Critically examines this politically controversial science**

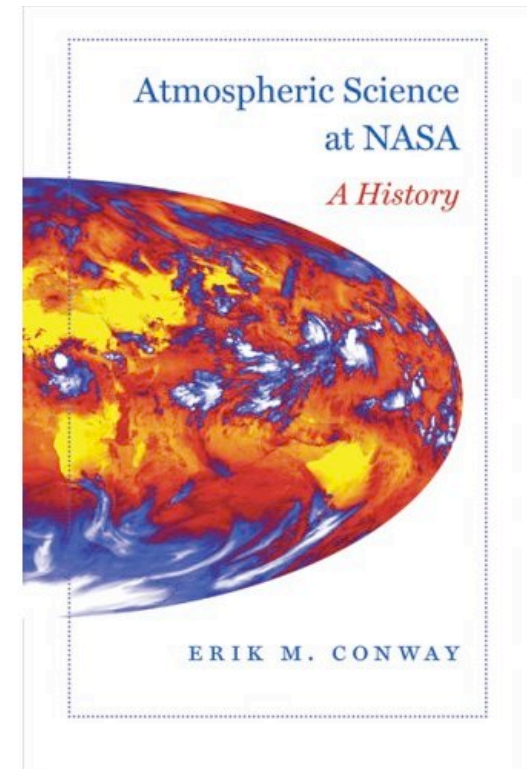
- Dissects the often convoluted roles, motives, and relationships of the various institutional actors involved -- among them NASA, congressional appropriation committees, government weather and climate bureaus, and the military.

---

"The author does an excellent job of telling this story -- translating the science into prose, characterizing the various personalities and institutions, organizing the convoluted tale into a narrative, and assessing interactions of multifarious factors. The work... will stand as a significant contribution to the literature. Much of the story has not yet been told, or if it has, certainly not in this detail or scope. It is likely to rank high in the top score or so of books

devoted to the history of space science."

-- *Joseph N. Tatarewicz, University of Maryland, Baltimore County*



Johns Hopkins University Press  
[http://www.press.jhu.edu/books/title\\_pages/9567.html](http://www.press.jhu.edu/books/title_pages/9567.html)